

APPENDIX A

1(a)-----

notes: In the Job class, Submit is the implementation of the client communications part through which a client requests the execution of the job. This implementation checks license and job validity to determine whether the batch job execution system is able to process the batch job [relevant to Claims 1, 9, 17]

source code excerpt:

```
def Submit (self, op):
    # This routine must not be viewable or changeable by customers. It
    checks the license.
    # It must not call out to another module or the customer could
    replace
    # that module.
    # If the license is not correct, it will raise basics.LicenseProblem
    Log("jdb", "Submission request received for job %s.", (self.ID(),))
    check_license()
    # Check validity
    if jobhelps.GetState(self) not in SubmitStates:
        Log("jdberr", "Attempted submit for job %s in inappropriate
        state.", (self.ID(),))
        raise basics.AccessDenied, "Submit"

    if op != job.JobOperation.Execute:
        Log("jdberr", "Bad operation %d requested for job %s.", (op,
        self.ID()))
        raise job.UnsupportedOperation
    self.SetAttributeNoSave(DatetimeAttribute ('SubmitDate',
    time.time()))
    self.SaveToDisk("in job_impl.Submit")
    try:
        self.jobmanager().Run(self)
    except:
        raise job.UnsupportedOperation
```

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1(b)-----
note: The ProcessSteps function extracts tasks (here called steps) from the batch job to be assigned to providers. [relevant to Claims 1, 9, 17, 24]

source code excerpt:

```
def ProcessSteps(job, stepList, stats, parent=None, save_to_disk=1):
    Log("jbex", "in ProcessSteps for %s", (str(job.ID()),))
    assnList = []

    if not parent:
        parent = job

    for step in stepList:
        step.dependentSteps = []

        # create dependencies for this stage's steps
        for step in stepList:
            provtype = CachedGetAttribute(step, 'ProviderType').value[1]
            if provtype == jobhelps.NoopService:
                SetStatus(attrib=step, state=status.State.Done,
                    secondary=status.SecondaryState.Success, dict=stats,
                    save_to_disk=0)
                continue
            # no need to look for dependent steps, because nothing will
            depend on a no-op
            step.parent = parent
            assn = InitializeStep(job=job, step=step, stats={},
                save_to_disk=0) # create empty values?
            assnValues = CachedGetAttribute(assn, 'Values').value[1]
            argattrib = CachedGetAttribute(step, 'Arguments').value[1]
            arguments = CachedGetAttributes(argattrib, [])
            for arg in arguments:
                argName = arg.name
                argValue = arg.value[1]
                argType = CachedGetAttribute(argValue, 'Type').value[1]

                # Output Arguments - nothing to do unless it is a temp
            destination
            if not arginfo.input_argp(provtype, argName) and argType !=
            'temp':
                continue

            # Input Arguments
            # We only read argSource for cases where we need it (so temp
            doesn't trip on it)
            if argType in ('job', 'param'):
                argSource = CachedGetAttribute(argValue, 'Source').value[1]
                jobVars = CachedGetAttribute(job, 'JobVariables').value[1]
                try:
                    valueAttribute = CachedGetAttribute(jobVars,
            argSource).value
                except attributed.AttributeUnknown:
                    raise ProgramStructureError, "argument %s with type %s
            has value %s and value has Source %s, which is not found in jobVars" %
            (argName, str(argType), str(argValue), str(argSource))
```

```

elif argType == 'super':
    argSource = CachedGetAttribute(argValue, 'Source').value[1]
    if not parent:
        raise ProgramStructureError, "'super' can only be used in
an epilogue step"
    else:
        values = parent.GetAttribute('Values').value[1]
        try:
            valueAttribute = values.GetAttribute(argSource).value
        except:
            raise ProgramStructureError, argSource
elif argType == 'literal':
    argSource = CachedGetAttribute(argValue, 'Source').value[1]
    valueAttribute = StrAttVal(argSource)
elif argType == 'temp':
    valueAttribute = StrAttVal(allocate_temp(job))
elif argType == 'step':
    AddDependentStep(step, stepList, arg)
else:
    raise ProgramStructureError, "Step: %s" %
CachedGetAttribute(step, 'Label').value[1]

if argType != 'step':
    valueAttribute = attributed.Attribute(argName,
valueAttribute)
    CachedSetAttribute(obj=assnValues, attr=valueAttribute,
save_to_disk=0)

# create assignment list
if not step.argumentsNotReady: # this step is ready to be assigned
    assnList.append((job, step, assn))
    SetStatus(attr=step, state=status.State.Processing,
secondary=status.SecondaryState.None, dict=stats,
save_to_disk=0)

# create endSteps
parent.endSteps = []
for step in stepList:
    if not step.dependentSteps:
        parent.endSteps.append(step)

if assnList:
    Log("jbex", " - returning assignment list with %d assignments",
(len(assnList),))
    if save_to_disk: job.SaveToDisk("ProcessSteps with assnList")
    return assnList
else: # if there are no assignments for this stage, go to the next
stage
    result = NoAssignments(job=job, stats=stats, save_to_disk=0)
    if save_to_disk: job.SaveToDisk("ProcessSteps without assnList")
    return result
# end of ProcessSteps

```

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1(c)-----
note: In the JMSAssigner class, AssignWork is the method which implements the assigning part: delegating a task to one of the plurality of service providers which gives a first signal, the first signal being the call to AssignWork. [relevant to Claims 1, 9, 13, 17, 24]

source code excerpt:

```
def AssignWork(self, provid, manager, frequency):
    DebugLog("jmgr", '%s: request from %s', (repr(self), provid))

    # Hold lock while manipulating assigner state
    self.lock.acquire('Assigner.AssignWork')
    try:
        if self.asmtqueue:
            # Real assignment to hand out
            asmt = self.asmtqueue[0]
            del self.asmtqueue[0]
            self.pollers = []
            self.lastalloc = time.time()
            self.delaycount = 0
            if self.stat_dict:
                self.stat_dict['queue-len'] = self.stat_dict['queue-
len']-1
        else:
            # Idle for now
            asmt = None
            if provid not in self.pollers:
                self.pollers.append(provid)
            # Once we start handing out idle assignments it is
            # reasonable to expect providers to go away, so we
            # should be prepared to ask for a capacity increase when
            # load builds again in the future
            self.inhibitIncrease = 0
        finally:
            self.lock.release('Assigner.AssignWork')

        # Prepare assignment and record it
        # Note that asmt here is the assignment structure for the Provider
        # It is *NOT* the assignment attributed!
        if asmt:
            # Determine the actual reporting frequency for the Provider
            if frequency > asmt.reportfreq:
                asmt.reportfreq = frequency
            else:
                frequency = asmt.reportfreq

            # Record assignment on job
            self.jobmanager.AssignmentAllocated(asmt, provid, self)
            Log("jmgr", '%s: allocating %s to %s', (repr(self), asmt.id,
provid))
        else:
            self.idlecount = self.idlecount + 1
            asmt = self.MakeIdleAsmt('idle-%d' % self.idlecount)
        # Return
        return asmt
```